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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/753,065	12/29/2000	Won-ick Jang	51876p232	9323

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EXAMINER

VINH, LAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 08/12/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/753,065

Applicant(s)

JANG ET AL

Examiner

Lan Vinh

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-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 December 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over McNeilly et al (US 5,294,568) in view of Reed et al (US 5,772,902)

McNeilly discloses a method for selective etching native oxide layer/silicon oxide layer on a substrate (all the native oxide will be etched/removed (see Abstract) reads on a sacrificial native oxide layer) by etching /removing the native oxide/sacrificial layer with a vapor etching employing anhydrous HF and vapor alcohol (col 7, lines 15-19; col 7, lines 44-45), McNeilly also discloses controlling the temperature and pressure in the reactor to delay condensation of water vapor (col 7, lines 35-38) reads on controlling a temperature and a pressure inside of an etching chamber to be within the region of a vapor of a phase equilibrium diagram of water.

Unlike the instant claimed invention as per claim 8, McNeilly does not specifically disclose removing silicon oxide of a sacrificial layer for a microstructure in a MEMS (micro electron mechanical system) device.

However, Reed discloses a method for inhibiting stiction of suspended micromechanical (MEMS) structure by removing a sacrificial silicon oxide layer in a release etch using wet HF etching (col 15, lines 25-28)

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Since both McNeilly and Reed are concerned with method of removing silicon oxide using HF, one skilled in the art would have found it obvious to employ McNeilly's teaching of removing the native oxide/sacrificial layer with a vapor etching employing anhydrous HF and vapor alcohol in Reed's step of removing a sacrificial silicon oxide layer in a MEMS device because McNeilly states that besides introducing fewer impurities, vapor phase HF processing has much more etch uniformity and control than wet etching (col 2, lines 63-65)

Regarding claim 9, McNeilly discloses the vapor pressure in the reactor is 10-30 Torr (fig. 13) overlaps the claimed range of 25-75 Torr

Regarding claim 10, McNeilly discloses that the wafer temperature /temperature inside the reactor is above about 27-28⁰ C (col 7, lines 32-33) overlaps the claimed range of 25-80 ⁰ C

3. Claims 1-3, 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over McNeilly et al (US 5,294,568) in view of Bergman et al (US 6,126,734) and further in view of Reed et al (US 5,772,902)

McNeilly discloses a method for selective etching native oxide layer/silicon oxide layer on a substrate. This method comprises the steps of:

passing water vapor/alcohol vapor and anhydrous HF in an inert gaseous carrier such as nitrogen through the reactor chamber (col 4, lines 6-8 ; col 7, lines 15-45) reads on supplying alcohol vapor bubbled with anhydrous HF

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heating the HF source (claimed supplying device) and the tube 33(claimed moving path) to supply HF/water/alcohol to the reactor (col 5, lines 34-36)

etching the native oxide with vapor HF/water/alcohol while controlling the temperature and pressure in the reactor to delay condensation of water vapor (col 7, lines 35-38) reads on performing a vapor etching by controlling a temperature and a pressure inside of an etching chamber to be within the region of a vapor of a phase equilibrium diagram of water.

removing the native oxide (silicon oxide) layer/sacrificial layer on a lower portion of the semiconductor substrate (col 6, lines 20-22 and fig. 1B2)

Unlike the instant claimed invention as per claim 1, McNeilly does not specifically disclose maintaining a temperature of the supplying device and a moving path of the anhydrous HF and the alcohol to be higher than a boiling point of the alcohol.

However, Bergman discloses a semiconductor processing method using vapor mixture, the method comprises the step of heating the vapor generator and vapor branch to a temperature of 20-100⁰ C (col 12, lines 7-10). Bergman's teaching reads on maintaining a temperature of the supplying device and a moving path of the anhydrous HF and the alcohol to be higher than a boiling point of the alcohol because a temperature at 100⁰ C is defined as the temperature higher than a boiling point of the alcohol in page 7 of the specification.

Since McNeilly discloses heating the HF vapor source (claimed supplying device) and the tube 33 (claimed moving path), one skilled in the art would have found it obvious to modify McNeilly's heating step by heating the HF source and the tube to a

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temperature of 100⁰ C as taught by Bergman because according to Bergman desired temperature for heating the vapor generator more preferably at 20-100⁰ C (col 11, lines 7-9)

McNeilly and Bergman do not specifically disclose removing silicon oxide of a sacrificial layer on the microstructure in a MEMS (micro electron mechanical system) device.

However, Reed discloses a method for inhibiting stiction of suspended micromechanical (MEMS) structure having amorphous/monocrystal silicon by removing a sacrificial silicon oxide layer in a release etch using wet HF etching (col 15, lines 25-28)

One skilled in the art would have found it obvious to employ McNeilly and Bergman teaching of removing the native oxide/sacrificial layer with a vapor etching employing anhydrous HF and vapor alcohol in Reed's step of removing a sacrificial silicon oxide layer in a MEMS device because McNeilly states that besides introducing fewer impurities, vapor phase HF processing has much more etch uniformity and control then wet etching (col 2, lines 63-65)

Regarding claim 2, McNeilly discloses the vapor pressure in the reactor is 10-30 Torr (fig. 13) overlaps the claimed range of 25-75 Torr

Regarding claim 3, McNeilly discloses that the wafer temperature /temperature inside the reactor is above about 27-28⁰ C (col 7, lines 32-33) overlaps the claimed range of 25-80 ⁰ C

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Regarding claim 5, McNeilly discloses forming thermal oxide layer (col 3, lines 66-67)

Regarding claim 6, McNeilly discloses using isopropyl alcohol (col 7, lines 18-19)

The limitation of claim 7 has been discussed above in paragraph 3.

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over McNeilly et al (US 5,294,568) in view of Bergman et al (US 6,126,734) and further in view of Reed et al (US 5,772,902) and Thakur et al (US 6,126,847)

McNeilly's method as modified by Bergman and Reed et al has been described above in paragraph 3. Unlike the instant claimed invention as per claim 4, McNeilly, Bergman and Reed do not disclose performing a wet etching step precedes the step of vapor etching the oxide layer.

However, Thakur discloses a method for etching oxide comprises the step exposing the oxide layer to a liquid/wet etching before the step of vapor etching the oxide layer (col 5, lines 65-67)

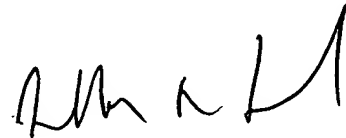
One skilled in the art would have found it obvious to modify McNeilly, Bergman and Reed by adding a step of liquid/wet etching before the step of vapor etching the oxide layer as per Thakur since Thakur teaches that it is desired to rapidly etch the silicon oxide layer using the wet etchant in an initial etch step before an vapor etch (col 4, lines 40-53)

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302. The examiner can normally be reached on M-F 8:30-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.



**JEFFRIE R. LUND
PRIMARY EXAMINER**

LV
August 7, 2002